Florida Power & Light Company, 6501 S. Ocean Drive, Jensen Beach, FL 34957

February 23, 2005

L-2005-042
10 CFR § 50.73

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

Re: St. Lucie Unit 2
Docket No. 50-389
Reportable Event: 2004-004-00
Date of Event: December 25, 2004
Manual Reactor Trip Due to Condensate Pump Motor Malfunction

The attached Licensee Event Report 2004-004 is being submitted pursuant to the requirements of 10 CFR § 50.73 to provide notification of the subject event.

Very truly yours,

William Jefferson, Jr.
Vice President
St. Lucie Nuclear Plant

WJ/KWF

Attachment

JE22

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 06/30/2007

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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4. TITLE

Manual Reactor Trip Due to Condensate Pump Motor Malfunction

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	[redacted]
12	25	2004	2004	- 004 -	00	02	23	2005	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE

1

10. POWER LEVEL

100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify In Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Kenneth W. Frehafer, Licensing Engineer	(772) 467 - 7748

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	SD	MO	A180	YES		-	-	-	-	-

14. SUPPLEMENTAL REPORT EXPECTED

				15. EXPECTED SUBMISSION DATE	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On December 25, 2004, St. Lucie Unit 2 was operating in Mode 1 at 100 percent reactor power. At 0651 hours, the control room operators performed a manual trip of the reactor after high temperatures were observed locally at the 2B condensate pump motor terminal box subsequent to the annunciation and indication of high motor current in the control room. Auxiliary feedwater initiated as expected from a full power reactor trip. The trip was uncomplicated as all safety-related equipment responded as required to the plant trip.

The 2B condensate pump motor over current condition was caused by the failure of the "A" phase motor lead that was the result of incorrect original construction motor lug installation.

Corrective actions included swapping the 2A condensate pump motor with the 2B pump, changes to the 4.16 and 6.9 kV motor overhaul program to check lug installation, and inspection of 4.16 and 6.9 kV motor lug installations.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

Description of the Event

On December 25, 2004, St. Lucie Unit 2 was operating in Mode 1 at 100 percent reactor power. At 0635 hours, Annunciator C-30, "AUX XFMR 2B 4.16 KV Ground," was received and then immediately cleared. Annunciator G-8, "2B/2C COND PP OVERLD/TRIP," was received approximately 30 seconds after Annunciator C-30 cleared. The 2B condensate pump motor ammeter was observed to be indicating off-scale high (the maximum on-scale indication is 800 Amps). The 2B condensate pump continued to operate in this condition. At 0640, the control room crew commenced a 20 gpm boration in accordance with 2-ONP-22.01. The nuclear plant operator (NPO) reported high temperature at the 2B condensate pump motor [EIIS:SB:MO] terminal box based on paint blistering on the box exterior. At 0643, the control room crew started a 10 MW/min down power. The NPO reported a burning smell in the vicinity of the 2B condensate pump motor. At 0651 hours, the crew performed a manual trip of the reactor and entered EOP-01, "Standard Post Trip Actions." All safety-related equipment responded as required to the plant trip. Auxiliary feedwater initiated as expected for a high power reactor trip. There were no equipment malfunctions.

An event response team was formed to investigate this event. The symptoms of the failure suggested that a loss of phase condition existed at the motor. Field cable and motor megger testing together with motor winding resistance testing suggested that phase A was an open circuit. The subsequent visual inspection of the terminal box revealed the extent of the motor lead failure; the "A" phase motor lead was severely damaged.

The 2B condensate pump motor was swapped with the 2A condensate pump motor. Once the repair was complete, a reactor startup commenced on December 27, 2004.

Cause of the Event

The cause of the 2B condensate pump over current condition was that an incorrectly installed motor lead lug degraded over the years, eventually resulting in arcing to the extent that the "A" phase motor lead vaporized. The investigation concluded that an incorrect lug and crimping tool were used on the motor termination [EIIS:SB:MO:CON]. Each manufacturer designs their lugs to be crimped by their tool and not a competitor's tool because each manufacturer's tool set places different stresses on the lugs to make a good electrical connection. The lugs are designed to react to the crimp tool stresses to make a good electrical connection. However, for reasons unknown, the lug manufacturer's crimping tool was not used during the original construction of St. Lucie Unit 2.

This condition led to the failure of the "A" phase motor lead. The undersized lug and crimping tool used during initial construction pinched the side strands of the conductor. The pinched strands provided the initial defect, eventually causing coronal arching at the motor lead lug that finally resulted in the vaporization of the motor lead. The vaporization allowed a momentary flash to ground, resulting in Annunciator C-30, AUX XFMR 2B 4.16 KV GROUND. With the "A" phase motor lead now missing, the motor continued to operate on only the "B" and "C" phases (single phase condition). Single phase operation resulted in the observed over current condition and explains why the pump motor ammeter was indicating off-scale high and why Annunciator G-8, "2B/2C COND PP OVERLD/TRIP," was received in the control room.

Analysis of the Event

This event is reportable under 10 CFR 50.73(a)(2)(iv) as a manual actuation of the reactor protection system and automatic actuation of the auxiliary feedwater system.

Analysis of Safety Significance

This event had minimal safety significance because uncomplicated reactor trips are analyzed events, and all equipment responded to the trip as required. Additionally, the control room crew used good judgment and conservatively tripped the reactor when it became apparent that the 2B condensate pump had to be secured immediately.

FPL assessed the generic implications of this event by conducting a review of condition reports, in house event reports, and work orders for motor lug issues that occurred at St. Lucie. All reports of degraded motor leads or motor lead lugs were included in this review because a failure that originated from an improperly installed lug may not be recognized as such. The presence of an improperly installed lug is not always obvious, and may require detailed dimensional measurements to confirm. The review determined that most of the failures involved 4.16 kV and 6.9 kV motors. Although several 480 volt failures were included in this review, the failure risk for 480 volt motor lead lugs is less because at the lower voltage, minor lug installation defects are less significant. Based on the above, during the SL2-15 refueling outage, lead lugs for 6 of 33 St. Lucie Unit 2 4.16 kV motors were inspected. The inspection sample included the 2B1 and 2B2 circulating water pump motors, the 2A and 2B condensate pump motors, the 2B turbine cooling water pump motor, and the 2B heater drain pump motor. The inspections showed that the correct lug size and crimp die size were used and that the lug and crimp tool manufacturers matched.

Because the contributing factors for this event are applicable to both St. Lucie units, motor lead inspections will be incorporated into the 4.16 kV and 6.9 kV motor overhaul program for both St. Lucie Unit 1 and Unit 2. Additionally, although the preliminary inspection results provide reasonable assurance that incorrect motor lug installation during original construction does not appear to be widespread, FPL is going to perform inspections of the entire population of St. Lucie Units 1 and 2 4.16 kV and 6.9 kV motor lugs.

Based on the above, this event had no adverse impact on the health and safety of the public.

Corrective Actions

1. The failed 2B condensate pump motor lugs were removed for failure analysis. The 2A condensate pump motor was swapped to the 2B condensate pump.
2. Six St. Lucie Unit 2 4.16 kV motor terminations were inspected during the SL2-15 refueling outage. Inspections of the 2B1 and 2B2 circulating water pump motors, the 2A and 2B condensate pump motors, the 2B turbine cooling water pump motor, and the 2B heater drain pump motor showed that the correct lug size and crimp die size were used and that the lug and crimp tool manufacturers matched.
3. Work requests were initiated to inspect the remaining St. Lucie Unit 1 and Unit 2 4.16 kV and 6.9 kV motor lead lugs during future refueling outages. The lugs will be inspected for correct size, matching manufacturer between lug and crimp tooling, and signs of deterioration.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

4. The safety-related and non safety-related motor overhaul procedures for St. Lucie Units 1 and 2 will be revised to include specific inspection criteria to ensure that the motor lead lugs are properly installed and show no signs of degradation. There are no planned overhauls scheduled in the near future, so these procedure changes will be completed by June 1, 2005.

Other Information

None

Failed Components Identified

Equipment: 2B condensate pump motor

Manufacturer: ALLIS-CHALMERS MFG. CO.

Model: 47302-2

Similar Events

None